

CTE Standards Unpacking ***Introduction to Energy/Power***

Course: Introduction to Energy/Power

Course Description: The Introduction to Energy and Power course is designed to provide a basic understanding of the various types of energy, how energy is obtained and the relationships among work, energy, and power. Students will also study the history and effects of energy on society, alternative power, safety and ethics.

Career Cluster: STEM

Prerequisites: None

Program of Study Application: This is a pathway course in the STEM cluster Energy pathway. It is recommended that the course be preceded by a series of foundation courses and a cluster course in STEM, and followed by a more specialized pathway course such as Alternative Energy Systems and Electronics.

INDICATOR #EP 1: Analyze the history of energy/power sources		
SUB-INDICATOR 1.1 (Webb Level: 2 Skill/Content): Examine the historical development of energy/power production		
SUB-INDICATOR 1.2 (Webb Level: 1 Recall): Assess the impact of energy/power on the way people live and work		
Knowledge (Factual): Examine the historical development of energy/power production. Investigate energy impacts on society, both positive and negative.	Understand (Conceptual): Energy and power has historical impact on society.	Skills (Application): Depict the development of engines. Research famous inventor. Develop power system. List various energy sources and machines used prior to the 21st century.
Benchmarks Students will be assessed on their <i>ability</i> to: <ul style="list-style-type: none"> Assess the impact of energy/power on the way people live and work. Define how the past use of energy and machines has negatively impacted the planet Earth. 		

Academic Connections	
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>9-12.H.1.4 Analyze how individuals and groups reacted to social, political, and economic problems in the U.S. from Reconstruction through the Progressive Era. (Courses: Modern, Comprehensive)</p> <p>9-12.H.2.6 Evaluate the impact the American Revolution had on politics, economy, and society.</p> <p>9-12.E.4.5 Differentiate between a developing and newly developed nations.</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p> <p>Research the 10 Energy Events that shaped the World. Create a timeline of historical energy events.</p>

INDICATOR #EP 2: Examine the relationships among work, energy, and power		
SUB-INDICATOR 2.1 (Webb Level: 1 Recall): Define work, power, and energy		
SUB-INDICATOR 2.2 (Webb Level: 2 Skill/Concept): Examine the relationship between power and energy sources		
<p>Knowledge (Factual): Define work, power, and energy.</p> <p>Apply mathematics formula that calculates power.</p> <p>Examine the relationship between power and energy sources.</p>	<p>Understand (Conceptual): Determine uses of work, power and energy.</p> <p>Power and energy relationships are defined.</p>	<p>Skills (Application): Differentiate between weight, mass, and force.</p> <p>Efficiency of a machine.</p>

Benchmarks

Students will be assessed on their *ability* to:

- Apply equations to find missing information pertaining to work, energy and power.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (SEP: 6; DCI: PS3.A, PS3.D, ETS1.A; CCC: Energy/Matter, Technology)

Sample Performance Task Aligned to the Academic Standard(s):

Energy NOVA Labs:
<http://www.pbs.org/wgbh/nova/labs/lab/energy/>

INDICATOR #EP 3: Understand the transmission of energy and power

SUB-INDICATOR 3.1 (Webb Level: 1 Recall): Understand how a mechanical system operates

SUB-INDICATOR 3.2 (Webb Level: 2 Skill/Concept): Understand the types of simple machines

SUB-INDICATOR 3.3 (Webb Level: Skill/Concept): Understand both liquid and gas forms of power transmission

SUB-INDICATOR 3.4 (Webb Level: 1 Recall): Understand the laws that govern electricity

Knowledge (Factual):

Classify power trains as being either direct or indirect.

Determine the

Understand (Conceptual):

Simple machines are defined.

Forms of fluid power will be identified.

Skills (Application):

Identify the parts of a power train.

Differentiate simple machines.

mechanical advantage of various simple machines.	Apply and memorize Ohm's Law.	Energy terms and symbols to units of measure.
Interpret the laws that govern fluids.		
State Ohm's Law.		
Benchmarks Students will be assessed on their <i>ability</i> to: <ul style="list-style-type: none"> Classify the mechanical advantage of various simple machines. List the various forms of fluid power. Define electrical quantities. 		
Academic Connections		
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): HS-PS2-1 Analyze data to support the claim that Newton's Second Law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. (SEP: 4; DCI: PS2.A; CCC: Cause/Effect). HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. (SEP: 5; DCI: PS3.A, PS3.B ; CCC: Systems). HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (SEP: 6; DCI: PS3.A, PS3.D, ETS1.A; CCC: Energy/Matter, Technology).	Sample Performance Task Aligned to the Academic Standard(s): Create simple and complex machines. Complete Physics Classroom ToolKit Modules: http://www.physicsclassroom.com/Teacher-Toolkits	

INDICATOR #EP 4: Understand alternative energy

SUB-INDICATOR 4.1 (Webb Level: 2 Skill/Concept): Understand the sources of alternative energy

SUB-INDICATOR 4.2 (Webb Level: 3 Strategic Thinking): Analyze the sources of alternative energy

<p>Knowledge (Factual): Compare and contrast the types of alternative energy sources.</p> <p>Investigate one or more of the alternative energy sources</p>	<p>Understand (Conceptual): Alternative energy sources will be defined and classified.</p> <p>Compare alternative energy sources.</p>	<p>Skills (Application): Alternative energy sources.</p> <p>Arguments on the environmental pros and cons for any one of the alternative energy sources.</p>
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Benchmarks

Students will be assessed on their *ability* to:

- Organize and prepare a presentation on synthetic fuels.
- Draw a model of an alternative energy apparatus.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):
<p>HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. (SEP: 5; DCI: ESS3.C; CCC: Stability/Change, Technology)</p> <p>HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural</p>	<p>Class debate on alternative energy sources and which one is the best.</p>

systems.* (SEP: 6; DCI: ESS3.C, ETS1.B; CCC: Stability/Change, Technology)
ET.CT.2 Students demonstrate the design process through problem solving.

INDICATOR #EP 5: Implement safety with power technology

SUB-INDICATOR 5.1 (Webb Level: 2 Skill/Concept): Examine safety issues relating to mechanical systems

SUB-INDICATOR 5.2 (Webb Level: 2 Skill/Concept): Employ safety practices with fluids

SUB-INDICATOR 5.3 (Webb Level: 1 Recall): Identify fire classification and extinguishers

SUB-INDICATOR 5.4 (Webb Level: 2 Skill/Concept): Employ safety practices with electricity

Knowledge (Factual):

Relate and follow safety rules pertaining to moving mechanical systems.

Apply safety rules relating to high-pressure lines.

Apply safety rules based on Occupational Safety and Health Administration (OSHA) standards Organize policies for the lab based on various emergency situations.

Understand (Conceptual):

Apply all lab safety rules.

Identify the types of fires.

Skills (Application):

Proper method of lifting, and cleanup method for fluids.

List which extinguisher will fight which type of fire.

Show how to use proper PPE (personal protective equipment).

Benchmarks

Students will be assessed on their *ability* to:

- Apply proper storage methods for flammable/toxic liquids.
- Identify the locations of fire extinguishers in the lab.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):
<p>OSHA 10 9-12.ET.CT.2.1 Compare and contrast methods for problem-solving and decision-making. IEEE Standards</p>	<p>Lab Safety ID Lesson Plan</p>

INDICATOR #EP 6: Understand scientific concepts for energy and power technology		
SUB-INDICATOR 6.1 (Webb Level: 1 Recall): Understand how energy converts from one form to another		
SUB-INDICATOR 6.2 (Webb Level: Skill/Concept): Understand the categories of energy		
SUB-INDICATOR 6.3 (Webb Level: 3 Strategic Thinking): Understand that an engine performing work exhausts thermal energy that cannot be retrieved to the surroundings		
SUB-INDICATOR 6.4 (Webb Level: 3 Strategic Thinking): Understand which energy sources can be renewable and non-renewable		
<p>Knowledge (Factual): Compare between potential and kinetic energy. Compare efficiency for multiple energy sources</p>	<p>Understand (Conceptual): Recall the concept of the Law of Conservation of Energy. Define the Law of Thermodynamics.</p>	<p>Skills (Application): Identify and classify sources of energy. Methods used to conserve energy.</p>
<p>Benchmarks Students will be assessed on their <i>ability</i> to:</p> <ul style="list-style-type: none"> Summarize various methods of transferring energy. Compare efficiency of various types of light bulbs. Investigate examples of renewable energy sources. Investigate examples of nonrenewable energy sources. 		
Academic Connections		

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):
<p>HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. (SEP: 2; DCI: PS1.A, PS1.B; CCC: Energy/Matter).</p> <p>HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. (SEP: 5; DCI: PS3.A, PS3.B ; CCC: Systems).</p> <p>HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (SEP: 6; DCI: PS3.A, PS3.D, ETS1.A; CCC: Energy/Matter, Technology)</p>	<p>The Great Energy Debate - National Geographic Society</p> <p>Lab - Which Grass Produces More Biomass?: Create a Hydropower-- Building a "Turbin-ator": & Build a better greenhouse</p>

INDICATOR #EP 7: Explore energy and power career options		
SUB-INDICATOR 7.1 (Webb Level: 3 Strategic Thinking): Research career opportunities in energy and power fields		
Knowledge (Factual): Investigate the career exploration software to research educational requirements for chosen career path.	Understand (Conceptual): Report about career opportunities in the energy and power fields	Skills (Application): Revise and update student portfolio
Benchmarks		

Students will be assessed on their *ability* to:

- Investigate and research career opportunities in the energy and power fields using career exploration software.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):

9-12.ET.CT.1.1 Analyze intended and unintended impacts of technology on careers, communities, and society.

9-12.ET.OC.1.2 Predict how the evolution of technology will shape the design and development of future technology.

9-12.ET.CI.1.3 Utilize technology for collaboration, research, publication, communication and productivity

9-12.ET.DC.1.5 Evaluate immediate and long-range effects of ethical and unethical uses of technology

Sample Performance Task Aligned to the Academic Standard(s):

SDMyLife
Job Service of S.D.

Additional Resources

Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.